Computer Software Engineers, Applications

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What They Do

Computer Software Engineers, Applications design, develop, and maintain computer applications software or specialized utility programs. These Engineers develop many types of applications for operating systems, network distribution, and compilers, which convert programs for execution on a computer. Their work evolves rapidly, reflecting new areas of specialization or changes in technology, as well as the preferences and practices of employers. Computer Software Engineers apply the principles and techniques of computer science, engineering, and mathematical analysis to the design, development, testing, and evaluation of the software and systems that enable computers to perform their many applications.

As computer software is improved or enhancements are made to systems, Computer Software Engineers oversee the updating, revision, and changes to applications. They develop new computer languages, operating systems, and applications packages that make full use of the advanced capabilities of computer hardware. The programming languages most often used are C, C++, and Java, with Fortran and COBOL used less commonly. Some Computer Software Engineers develop both packaged systems and systems software or create customized applications.

Tasks

- Analyze information to determine, recommend, and plan computer specifications and layouts, and peripheral equipment modifications.
- Analyze user needs and software requirements to determine feasibility of design within time and cost constraints.
- Confer with systems analysts, engineers, programmers and others to design system and to obtain information on project limitations and capabilities, performance requirements and interfaces.
- Coordinate software system installation and monitor equipment functioning to ensure specifications are met.
- Design, develop, and modify software systems, using scientific analysis and mathematical models to predict and measure outcome and consequences of design.
- Determine system performance standards.
- Develop and direct software system testing and validation procedures, programming, and documentation.
- Modify existing software to correct errors, allow it to adapt to new hardware, or to improve its performance.

*Detailed descriptions of this occupation may be found in the Occupational Information Network (O*NET) at online.onetcenter.org.*

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Important Skills, Knowledge and Abilities

- Operations Analysis — Analyzing needs and product requirements to create a design.
- Programming — Writing computer programs for various purposes.
- Troubleshooting — Determining causes of operating errors and deciding what to do about it.
- Active Learning — Understanding the implications of new information for both current and future problem-solving and decision-making.
- Speaking — Talking to others to convey information effectively.
- Computers and Electronics — Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.
- Engineering and Technology — Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.
- Mathematics — Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- English Language — Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.
- Design — Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.
- Written Comprehension — The ability to read and understand information and ideas presented in writing.
- Oral Comprehension — The ability to listen to and understand information and ideas presented through spoken words and sentences.
- Inductive Reasoning — The ability to combine pieces of information to form general rules or conclusions (includes finding a relationship among seemingly unrelated events).
- Deductive Reasoning — The ability to apply general rules to specific problems to produce answers that make sense.

Work Environment

Computer Software Engineers, Applications work in well-lighted and comfortable offices or computer laboratories in which the computer equipment is located. Computer Software Engineers who are employed by software vendors and consulting firms spend much of their time away from their offices, frequently traveling overnight to meet with customers. They call on customers in businesses ranging from manufacturing plants to financial institutions. Computer Software Engineers may be able to use modems, laptops, e-mail, and the Internet to provide more technical support and other services from their main office or home, connecting to a customer's computer remotely to identify and correct developing problems.

Computer Software Engineers may experience eye strain, back discomfort, and hand and wrist problems after sitting and typing for hours on a computer keyboard. Software Engineers often work more than 40 hours a week and, due to the project-oriented nature of their work, may work evenings and weekends to meet deadlines or solve technical problems.

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California's Job Outlook and Wages

The California Outlook and Wage chart below represents the occupation across all industries.

Standard Occupational Classification	Estimated Number of Workers 2004	Estimated Number of Workers 2014	Average Annual Openings	2006 Wage Range (per hour)
Computer Software Engineers, Applications				
15-1031	84,400	123,600	4,750	$33.03 to $53.37

Wages do not reflect self-employment.
***Average annual openings** include new jobs plus net replacements.*
Source: www.labormarketinfo.edd.ca.gov, Employment Projections by Occupation and OES Employment & Wages by Occupation, Labor Market Information Division, Employment Development Department.

Trends

Computer Software Engineer jobs are projected to increase much faster than the average for all occupations in California, up 46% between 2004 and 2014. Additionally, there will be approximately 830 workers needed each year to replace workers who leave for other types of work or retirement.

The highest growth will be seen in computer systems design, software publishing, Internet service providers and web search portals, management of companies and enterprises, and management and technical consulting services firms. These sectors alone will add more than 25,000 new jobs to the California economy in the ten-year period.

Large growth will occur as businesses and other organizations continue to adopt and integrate new technologies and maximize the efficiency of their current computer systems. Employers will continue to seek computer professionals with strong programming, systems analysis, interpersonal, communications, and business skills. Competition among businesses will create an incentive for increasingly sophisticated technological innovations, and organizations will need more Computer Software Engineers to implement these new technological changes.

Training/Requirements/Apprenticeships

Most employers prefer to hire Computer Software Engineers, Applications who have at least a bachelor's degree and broad knowledge and experience with computer systems and technologies. Computer Software Engineers usually focus their studies on computer science or information systems. Employers with jobs that are more complex and require a high degree of technical knowledge often prefer a person with a master's degree.

Many students seeking software engineering jobs enhance their employment opportunities by participating in internships offered through their schools. These experiences provide students with broad knowledge and valuable hands on real world experience, making them attractive candidates to employers. In many firms, mentoring has become part of the evaluation process for new hires.

Professional certification is now offered by the Institute of Electrical and Electronics Engineers (IEEE) Computer Society. To be classified as a Certified Software Development Professional, individuals need a bachelor's degree and work experience that demonstrates that they have mastered a relevant body of knowledge, and must pass a written exam.

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Computer Software Engineers should be knowledgable about the different operating systems used by the industry. They must have the ability to problem-solve and configure operating systems to work with all kinds of hardware and adapt the systems to meet the needs of the organization.

Employers demand new skills as technology continually evolves and advances in the computer field. Software Engineers must acquire these new skills if they wish to remain in this extremely competitive and dynamic field. To help keep up with the changing technology, continuing education and professional development seminars are offered by employers and software vendors, colleges and universities, and private training institutions.

Recommended High School Course Work
High school students interested in this kind of work should take English (communications), mathematics, computer science, and software engineering courses.

Where Do I Find the Job?

The largest concentration of Computer Software Engineers work in computer systems design firms. Others work for government agencies, manufacturers of computers and related electronic equipment, colleges and universities, the military, and engineering services. Some consultants work for firms that specialize in developing and maintaining clients' Web sites and intranets.

Direct application to employers remains one of the most effective job search methods.

Use the *Search for Employers by Industry* feature on the *Career Center* page at www.labormarketinfo.edd.ca.gov to locate employers in your area. Search using keywords from the following manufacturing industry names to get a list of private firms and their addresses:

- Computer Storage Devices
- Computer Systems Design Services
- Custom Computer Programming Services
- Electricity & Signal Testing Instruments
- Electromedical Apparatus
- Electronic Computers
- Industrial Process Variable Instruments
- Other Computer Peripheral Equipment
- Other Computer Related Services
- Other Measuring and Controlling Devices
- Search, Detection, Navigation & Instrument
- Software Publishers

Search these **yellow page** headings for listings of private firms:

- Computer Manufacturers
- Data Networks
- Computer Networks
- Computer Software Developers
- Computer System Designers
- Information Technology Services
- Internet Software and Services
- Web Site Services

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Where Can the Job Lead?

A career path for Computer Software Engineers, Applications might lead to supervisory or managerial positions within the Information Technology (IT) department of a firm, particularly for those who have high levels of communication and project management skills. Engineers with degrees in specialties such as electronics, aerospace, or industrial engineering will have many opportunities to make lateral moves into other departments and positions.

Other Sources of Information

Association for Computing Machinery
www.acm.org

National Workforce Center for Emerging Technologies
www.nwcet.org

IEEE Computer Society
www.computer.org

Institute for the Certification of Computing Professionals
www.iccp.org

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